

ARTERY OF PERCHERON INFARCTION OF THE BRAIN: CLINICAL CASE

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Background. The artery of Percheron is an anatomical version of the cerebral vasculature, in which one artery, departing from the proximal part of one of the posterior cerebral arteries, supplies the paramedial thalamus and the rostral part of the midbrain. The artery of Percheron stroke is often manifested by impaired consciousness, oculomotor disorders and neuropsychological symptoms. The diagnostics of the artery of Percheron stroke is carried out using computed tomography and/or magnetic resonance imaging (MRI). Intravenous thrombolysis and endovascular treatment methods are used upon admission within the “therapeutic window”. Further secondary prevention is recommended. The prognosis is favorable with the timely treatment. **Clinical case description.** A clinical case of a 43-year-old woman with acute oculomotor disorders is presented. The neurological examination revealed paresis of the vertical gaze, diplopia. MRI showed a bilateral acute infarction of both paramedial thalamuses. After the treatment, the patient was discharged with a minimal neurological deficit. **Conclusion.** Percheron artery occlusion is a rare form of cerebral infarction. Early diagnosis, in particular neuroimaging and angiography, allows for a timely adequate treatment, which has a positive effect on the rehabilitation.

Keywords: artery of Percheron, brain infarction, thalamic infarction, clinical case.

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BACKGROUND

The artery of Percheron is an anatomical variant where one artery extending from the proximal part of one of the posterior cerebral arteries (PCA) is a source of bilateral blood supply for the paramedial segments of thalamuses and the rostral part of the midbrain. The artery of Percheron was first described in 1973 by the French physician and research scientist Gerard Percheron [1].

Epidemiology

Occlusion of the artery of Percheron accounts for about 2% of total cases of cerebral infarction and causes almost 35% of cases of thalamic infarction [2].

Pathogenesis

The main sources of blood supply to the midbrain (its upper part), thalamus and posterior lower parts of the cerebral hemispheres (occipital lobes, mediobasal parts of the temporal lobes and lower medial parts of the parietal lobes) are paired PCA which are formed as a result of the basilar artery bifurcation [2]. A common cause of isolated infarctions in the PCA territory (80% of cases) is embolic occlusion of the PCA and its branches; in 20% of cases, thrombosis *in situ*, migraine-associated vasoconstriction, and coagulopathy

are detected. Arterial blood supply to the thalamus is normally implemented using the branches of five arteries — thalamoperforating; thalamogeniculate; posterior choroidal, which are the PCA branches; anterior choroidal (branches of the internal carotid artery); polar (tubulothalamic arteries as branches of the posterior communicating artery) [3].

With occlusion of the thalamoperforating artery of Percheron, 4 variants of ischemia are possible:

- 1) bilateral paramedial thalamic infarction with involvement of the midbrain;
- 2) isolated bilateral paramedial thalamic infarction;
- 3) bilateral combined infarction of the paramedial and anterior regions of the thalamus together with the midbrain;
- 4) bilateral infarction of the paramedial and anterior thalamic zones (rarely) [4].

Clinical presentation

The thalamus contains functionally important cell nuclei that regulate several important processes. With unilateral damage to the thalamic nuclei, their function is performed by the intact thalamus, while bilateral damage leads to clinically visible disorders [5].

The aspects of the clinical presentation in infarctions in the artery of Percheron are diverse:

- disorders of eye movement are manifested as horizontal and vertical paresis of the gaze and may be accompanied by a disorder of the pupil's reaction to light;
- memory and behavior disorders, including confusion, apathy, disinhibition;
- paresis or paralysis of the facial muscles, muscles of the upper or lower extremities;
- coordination disorders such as ataxia and/or dysmetria;
- aphasia or dysarthria;
- changes in mental status;
- other nonspecific clinical manifestations [4].

Suppression of consciousness is believed to be a mandatory symptom [6].

Diagnosics

Computed tomography (CT) and/or magnetic resonance imaging (MRI) are used to visualize the ischemic focus. On MRI examination, the ischemic focus is represented by a hyperintense signal, including the paramedial regions of the thalamus with/without involvement of the midbrain. In 67% of cases, the so-called V-sign of the midbrain is registered, which can be seen on axial diffusion-weighted or FLAIR images where it is represented by a V-shaped hyperintense area on the surface of the midbrain, which forms the posterior wall of the interpeduncular fossa [6, 7].

Differential diagnostics

Bilateral damage to the thalamus can occur as a result of infectious, toxic and metabolic processes (viral encephalitis, Wilson's disease, Fahr's disease), with vascular lesions (occlusion of the artery of Percheron, vein of Galen, aneurysm of the main artery), tumor growth (gliomas, astrocytomas), and Creutzfeldt-Jacob disease [1, 6, 8, 9].

In arterial or venous lesion, factors such as the area of the lesion and the cerebral edema should be considered. Deep vein involvement can lead to venous hypertension, resulting in an acute headache with nausea and seizures. At the same time, venous infarctions of a larger size do not have a clear vascular territory and are accompanied by edema [10].

Treatment

When hospitalized during the "therapeutic window", intravenous thrombolysis and endovascular methods of treatment are used. Secondary prevention includes the prescription of antithrombotic, antihypertensive, lipid-lowering therapy, and glycemic control [6, 11, 12].

CLINICAL CASE

Patient information

Female patient K., 43 years old, from a secured family, with normal growth and development. She denied having had bad habits. Family history: married, has one child (Rett syndrome).

02/04/2020 in the morning after waking up, she noticed diplopia and unsteady gait. The patient went to an outpatient ophthalmologist who revealed no pathology. After 6 hours, due to the persistence of complaints, she called an ambulance team, was hospitalized in the regional vascular center of the Leningrad Regional Clinical Hospital (LRCH, St. Petersburg).

Diagnostic procedures

Physical diagnostics

Neurological status at admission showed clear consciousness, and preserved orientation in place, time, and self-identity. There was no aphasia. The pupils were equal, the photoreactions were active. There was no hemianopsia. The movements of the eyeballs were limited upwards (mainly OS). Diplopia when looking to the right and to the left was detected. Facial musculature had no asymmetry. The tongue was in the midline. Swallowing and speech were not impaired. Normal muscle tone and full strength were registered. There were no pathological reflexes. Sensitivity was not compromised. The patient performed coordination tests satisfactorily. There were no meningeal signs. Assessment on the scale of stroke severity of the US National Institutes NIHSS was 2 points.

Instrumental and laboratory diagnostics

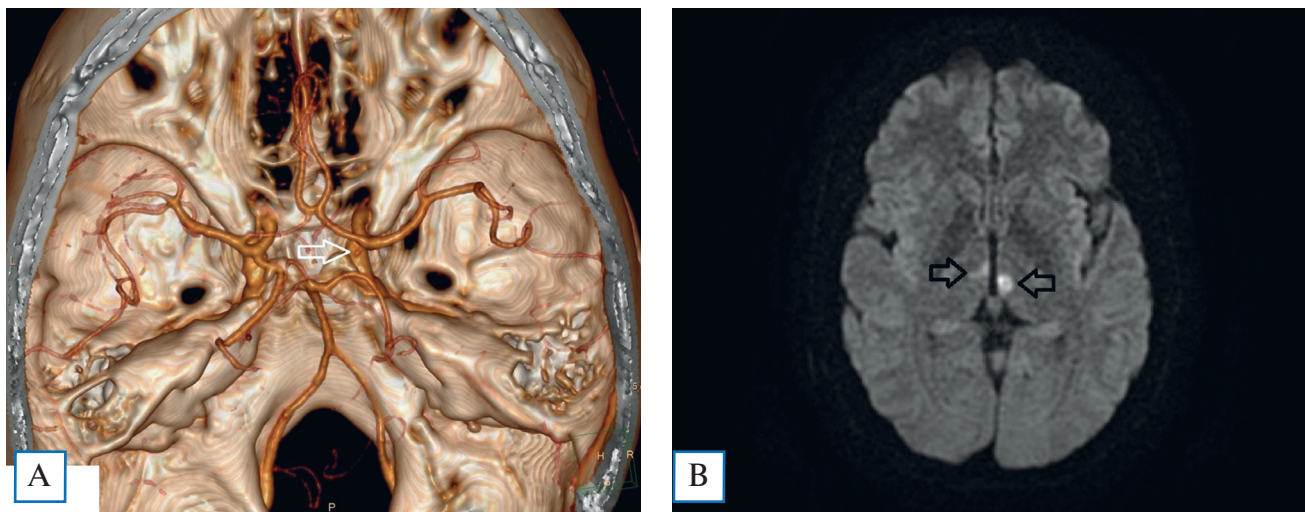
On admission, CT and MRI of the brain were performed. CT scan revealed no pathology in the brain matter. The spiral CT angiography revealed partial posterior trifurcation of the left internal carotid artery, a branch of the right superior cerebellar artery from the P1 segment of the right PCA, and presumably saccular aneurysm of the A1 segment of the right anterior cerebral artery (near the orifice) (Fig. 1, A).

MRI result showed the MRI picture of bilateral acute lacunar infarction in the paramedial parts of both thalamuses (up to 6 mm on the left, up to 4.5 mm on the right), infarction in the artery of Percheron (Fig. 1, B).

Ultrasound examination of the arteries of the neck revealed no hemodynamically significant local disorders.

Echocardiography revealed the initial manifestations of left ventricular hypertrophy. The electrocardiogram showed disorders of intra-atrial and intraventricular conduction.

Fig. 1. Patient K., 43 years old, with cerebral infarction in the vertebrobasilar system (artery of Percheron): examination results.



Note. A — spiral CT angiography of the brain with 3D reconstruction (the arrow indicates saccular aneurysm of the right anterior cerebral artery, presumably); B — MRI of the brain, DWI mode (arrows show lacunar foci of acute ischemia in the paramedial thalamus).

The patient was examined by a neurosurgeon for a suspected saccular aneurysm of the right anterior cerebral artery, she did not require emergency surgery; consultation at a neurosurgical institute, blood pressure monitoring and spiral CT angiography after 3, 6, and 12 months were recommended.

In addition, studies were performed on the blood concentration of homocysteine ($7.63 \mu\text{mol/l}$), and the determination of 12 polymorphisms of the blood coagulation system and the folate cycle. A mutant homozygote MTHFR 677 T/T was found (associated with the risk of hyperhomocysteinemia, pregnancy complications, atherosclerosis, and thrombosis).

Provisional diagnosis

Cerebral infarction in the vertebrobasilar system (artery of Percheron) from 02/04/2020.

Clinical diagnosis

Cerebral infarction in the vertebrobasilar system (artery of Percheron) from 02/04/2020, lacunar subtype.

Change over time and outcomes

Change over time of neurological deficit during hospitalization:

In 02/05/2020, movements of the eyeballs were limited upwards (OS > OD), converging horizontal nystagmus with a rotatory component was revealed. Finger-nose test was with past-pointing on the right. There was NIHSS 2 (stroke severity assessment), Rivermead 7 (mobility index), Bartel 80 (assessment of the

patient's level of daily activity to decide on the need in care), Rankin 3 (degree of disability after a stroke).

In 02/06–08/2020 (examination in the ward), eye movements were minimally limited upwards; with diplopia when looking to the right, left, downwards and upwards.

In 02/09–12/2020, there were no complaints of diplopia; and minimal restrictions on upward eye movement were registered.

During hospitalization, she received antiplatelet (acetylsalicylic acid, 100 mg), hypotensive (enalapril at a dose of 5 mg 2 times a day), neuroprotective therapy, physiotherapy, and exercise therapy.

On February 13, 2020, the patient was discharged in satisfactory condition for outpatient treatment with minimal neurological deficit in the form of slight upward gaze paresis. NIHSS score was 0, Rankin was 1, Rivermead was 15, and Bartel was 100.

Prognosis

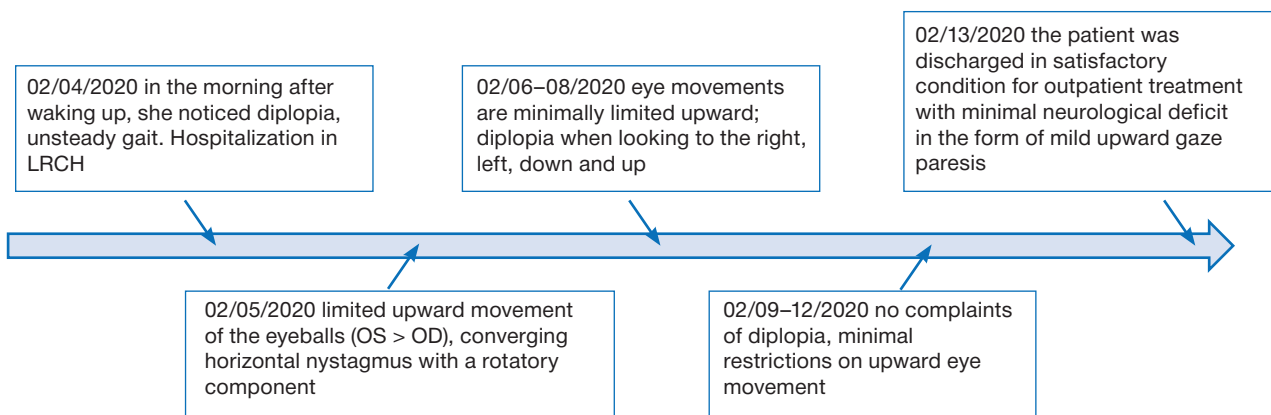
The prognosis for life, recovery, and work capacity was favorable.

Timeline (Fig. 2)

DISCUSSION

According to various sources, cerebral infarction in the PCA system is from 5–10% to 25% of all ischemic strokes. The range of clinical manifestations of such lesions is very variable and is not always recognized timely and adequately by the patients themselves, their relatives, and doctors. After all, an acutely arisen gross

Fig. 2. Patient K., 43 years old, with cerebral infarction in the vertebrobasilar region (artery of Percheron): chronology of the disease development, key events, and prognosis.



motor deficit, which is usually associated with a stroke, in this case, may be unexpressed or completely absent. At the same time, late or incorrect diagnosis call into question the possibility of adequate therapy, primarily thrombolytic therapy [2, 4, 7].

Occlusion of the artery of Percheron is the only clinical and anatomical variant that leads to bilateral damage to the thalamus with/without involvement of the midbrain. The incidence of bilateral thalamic lesions is only 4.6% of all isolated thalamic infarctions, and usually such infarctions are asymmetric. Thalamic infarction is more often localized in the paramedial and inferolateral areas, less often in the border vascular zones (lateral and central) [8, 11]. Upward gaze paresis suggests involvement of the midbrain, but is also registered in patients without damage to it, which is probably due to a disorder of the cortical fibers crossing the thalamus on their way to the medial longitudinal fascicle [12].

The clinical case presented demonstrates the development of cerebral infarction in the artery of Percheron system in a patient with background vascular anomalies of the brain (partial posterior trifurcation of the internal carotid artery, branching of the right superior cerebellar artery from the P1 segment of the right PCA). In our opinion, the management of such patients requires a detailed neuroimaging and angiographic study, as well as compliance with other standards of care for patients with stroke. When a patient is hospitalized during the “therapeutic window” and in case of absence of contraindications, the thrombolytic therapy should be considered.

CONCLUSION

The artery of Percheron occlusion is a rare form of cerebral infarction. Early diagnostics, in particular neuroimaging and angiography, enables to perform timely

adequate treatment, which has a positive effect on the rehabilitation prognosis.

INFORMED CONSENT

Written voluntary informed consent was obtained from the patient to publish the description of the clinical case. It was signed on 02/13/2020.

ADDITIONAL INFORMATION

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AUTHOR CONTRIBUTIONS

N.L. Barilyak, G.V. Ponomarev, and I.G. Shatsman reviewed the publications on the subject of the article, wrote the text of the article; N.V. Zhukovskaya, A.A. Skoromets wrote the text of the article, exercised the methodological guidance. All authors made a significant contribution to the search and analytical work and preparation of the article, read and approved the final version before its publication.

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